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Serial No.10/614,019
Office Action dated January 11, 2007

AMENDMENTS TO THE CLAIMS

The following listing of claims replaces all prior listings, and all prior versions, of claims in the application.

LISTING OF CLAIMS:

1. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body, wherein said controller performs (1) in the state that said living body stops exhalation or inspiration, control of a first pulse sequence detecting said nuclear magnetic resonance signal to acquire a reference projection of an imaging section as the reference of monitoring of respiratory motion of said living body; (2) In the state that said living body breathes, control of executing once said first pulse sequence detecting said nuclear magnetic resonance signal to acquire a projection of said imaging section used for said monitoring and In the state that said living body breathes, of repeating a second pulse sequence detecting said nuclear magnetic resonance signal to acquire an image of said imaging section at predetermined repetition time intervals; and (3) control of collecting said nuclear magnetic resonance signals used for image reconstruction of said imaging section In said second pulse sequence based on a similarity coefficient between said projection and said reference projection, said similarity coefficient being scalar.

2. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in

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a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body, wherein said controller performs (1) in the state that said living body stops exhalation or inspiration, control of a first pulse sequence detecting said nuclear magnetic resonance signal to acquire a reference projection of an imaging section as the reference of monitoring of respiratory motion of said living body; (2) in the state that said living body breathes, control of executing once said first pulse sequence detecting said nuclear magnetic resonance signal to acquire a projection of said imaging section used for said monitoring and in the state that said living body breathes, of repeating a second pulse sequence detecting said nuclear magnetic resonance signal to acquire an image of said imaging section at predetermined repetition time intervals; (3) control of collecting said nuclear magnetic resonance signals used for the image reconstruction of said imaging section in said second pulse sequence by monitoring respiratory motion of said living body based on a similarity coefficient between said projection and said reference projection, said similarity coefficient being scalar; and (4) control of repeating said (2) to said (3).

3. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body and an arithmetic processor using said detected nuclear magnetic resonance signal to perform image reconstruction of an imaging section, wherein said controller performs (1) in the state that said living body stops exhalation or Inspiration, control of a first pulse sequence detecting said nuclear magnetic resonance signal; and (2) in the state that said living body breathes, control of executing once said first

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pulse sequence and in the state that said living body breathes, of repeating a second pulse sequence detecting said nuclear magnetic resonance signal at predetermined repetition time intervals, said arithmetic processor performs (a) arithmetic processing of acquiring a reference projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (1); (b) arithmetic processing of acquiring a projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (2); and (c) arithmetic processing of determining a similarity coefficient between said projection and said reference projection, and said controller performs (3) control of monitoring respiratory motion of said living body based on said similarity coefficient to collect said nuclear magnetic resonance signals used for said image reconstruction in said second pulse sequence, said similarity coefficient being scalar; and (4) control of repeating said (2) to said (3).

4. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 3, wherein in said (3), said controller monitors said motion based on comparison of a value of said similarity coefficient with a predetermined threshold value.

5. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body and an arithmetic processor using said detected nuclear magnetic resonance signal to perform image reconstruction of an imaging section, wherein said

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controller performs (1) in the state that said living body stops exhalation or inspiration, control of a first pulse sequence detecting said nuclear magnetic resonance signal; (2) in the state that said living body breathes, control of executing once said first pulse sequence; (3) in the state that said living body breathes, control of repeating a second pulse sequence detecting said nuclear magnetic resonance signal at predetermined repetition time intervals; and (4) control of repeating said (2) to said (3), said arithmetic processor performs (a) arithmetic processing of acquiring a reference projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (1); (b) arithmetic processing of acquiring a projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (2); and (c) arithmetic processing of determining a similarity coefficient between said projection and said reference projection, said similarity coefficient being scalar, and said controller performs (5) control of collecting said nuclear magnetic resonance signals used for said image reconstruction in said second pulse sequence based on comparison of a value of said similarity coefficient with a predetermined threshold value.

6. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body and an arithmetic processor using said detected nuclear magnetic resonance signal to perform image reconstruction of an imaging section, wherein said controller performs (1) in the state that said living body stops exhalation or inspiration, control of a first pulse sequence detecting said nuclear magnetic resonance signal; (2)

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in the state that said living body breathes, control of executing once said first pulse sequence; and (3) control of repeating a second pulse sequence detecting said nuclear magnetic resonance signal at predetermined repetition time intervals, said arithmetic processor performs (a) arithmetic processing of acquiring a reference projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (1); (b) arithmetic processing of acquiring a projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (2); and (c) arithmetic processing of determining a similarity coefficient between said projection and said reference projection, said similarity coefficient being scalar, and said controller performs (4) control of collecting said nuclear magnetic resonance signals used for said image reconstruction in said second pulse sequence based on said similarity coefficient.

7. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body and an arithmetic processor using said detected nuclear magnetic resonance signal to perform image reconstruction of an imaging section, wherein said controller performs (1a) in the state that said living body stops exhalation, control of a first pulse sequence detecting said nuclear magnetic resonance signal; (2) in the state that said living body breathes, control of executing once said first pulse sequence; and (3) control of repeating a second pulse sequence detecting said nuclear magnetic resonance signal at predetermined repetition time intervals, said arithmetic processor performs (a) arithmetic processing of acquiring a reference projection of said imaging

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section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (1a); (b) arithmetic processing of acquiring a projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (2); and (c) arithmetic processing of determining a similarity coefficient between said projection and said reference projection, said similarity coefficient being scalar, and said controller performs (4) control of collecting said nuclear magnetic resonance signals used for said image reconstruction in said second pulse sequence when a value of said similarity coefficient is larger than a predetermined threshold value.

8. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 7, wherein said controller executes once said first pulse sequence of said (1a).

9. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 7, wherein said controller performs control of repeating said first pulse sequence of said (1a) at said predetermined repetition time intervals, and said arithmetic processor obtains an average of projections of said imaging section acquired from said nuclear magnetic resonance signals detected by repeating said first pulse sequence of said (1a) as said reference projection.

10. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 7, wherein between control of said (1a) and control of said (2), said controller performs (1b) in the state that said living body breathes, control of repeating said first pulse sequence at said predetermined repetition time intervals, and said

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arithmetic processor performs arithmetic processing of determining frequency of appearance of said similarity coefficient between a projection of said imaging section acquired from said nuclear magnetic resonance signals detected by repeating said first pulse sequence of said (1b) and said reference projection and decides, as said predetermined threshold value, said similarity coefficient in which the sum of said frequency of appearance in a part in which said similarity frequency is close to 1 is $1/m$ of the sum of said frequency of appearance where m is a positive number of 3 or above.

11. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body and an arithmetic processor using said detected nuclear magnetic resonance signal to perform image reconstruction of an imaging section, wherein said controller performs (1) in the state that said living body stops exhalation, control of a first pulse sequence detecting said nuclear magnetic resonance signal; (2) in the state that said living body breathes, control of repeating said first pulse sequence at predetermined repetition time intervals; (3) in the state that said living body breathes, control of executing once said first pulse sequence; (4) control of repeating a second pulse sequence detecting said nuclear magnetic resonance signal at said predetermined repetition time intervals; and (5) control of repeating said (3) to said (4), said arithmetic processor performs (a) arithmetic processing of acquiring a reference projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (1); (b) arithmetic processing of

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acquiring a projection of said imaging section from said nuclear magnetic resonance signal detected in said first pulse sequence of said (2); (c) arithmetic processing of determining a similarity coefficient between said projection and said reference projection, said similarity coefficient being scalar; and (d) arithmetic processing of determining a predetermined threshold value from frequency of appearance of said similarity coefficient, and said controller performs (6) control of collecting said nuclear magnetic resonance signals used for said image reconstruction in said second pulse sequence when a value of said similarity coefficient is larger than said predetermined threshold value.

12. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 11, wherein said similarity coefficient in which the sum of said frequency of appearance in a part in which said similarity frequency is close to 1 is $1/m$ of the sum of said frequency of appearance where m is a positive number of 3 or above is decided as said predetermined threshold value.

13. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body and an arithmetic processor using said detected nuclear magnetic resonance signal to perform image reconstruction of an imaging section, wherein said controller performs (1) in the state that said living body stops exhalation, control of executing a first pulse sequence having a first time section applying, to said living body, a slice select magnetic field gradient having a positive polarity and a

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radiofrequency magnetic field, a second time section applying, to said living body, a readout magnetic field gradient having a negative polarity, a third time section detecting said nuclear magnetic resonance signal in the state of applying said readout magnetic field gradient having a positive polarity, and a fourth time section applying, to said living body, said readout magnetic field gradient having a negative polarity; (2) in the state that said living body breathes, control of executing once said first pulse sequence; (3) in the state that the living body breathes, control of executing, after said first pulse sequence of said (2), a second pulse sequence repeating, at predetermined repetition time intervals, a pulse sequence having a fifth time section applying, to said living body, said slice select magnetic field gradient having a positive polarity and said radiofrequency magnetic field, a sixth time section applying, to said living body, respective magnetic field gradients of a phase-encoding magnetic field gradient and a readout magnetic field gradient having a negative polarity, a seventh time section detecting said nuclear magnetic resonance signal in the state of applying said readout magnetic field gradient having a positive polarity, and an eighth time section applying, to said living body, said phase-encoding magnetic field gradient having the opposite polarity of the polarity of said phase-encoding magnetic field gradient applied in said second time section and said readout magnetic field gradient having a negative polarity, by changing the magnitude of said phase-encoding magnetic field gradient; and (4) control of repeating said (2) to said (3), said arithmetic processor performs (a) arithmetic processing of one-dimensional inverse Fourier transforming said nuclear magnetic resonance signal detected in said first pulse sequence of said (1) to acquire a reference projection of said imaging section in the direction applying said readout magnetic field gradient of said imaging section; (b) arithmetic processing of one-dimensional inverse Fourier transforming said nuclear magnetic resonance signal

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detected in said first pulse sequence of said (2) to acquire a projection in the direction
applying said readout magnetic field gradient of said imaging section; and (c)
arithmetic processing of determining a similarity coefficient between said projection
and said reference projection, said similarity coefficient being scalar, and said
controller performs (5) control of collecting said nuclear magnetic resonance signals
used for said image reconstruction in said second pulse sequence based on
comparison of a value of said similarity coefficient with a predetermined threshold
value.

14. (Original) The inspection apparatus using nuclear magnetic resonance
according to claim 13, wherein said controller performs control of collecting said
nuclear magnetic resonance signals used for said image reconstruction in said
second pulse sequence when a value of said similarity coefficient is larger than a
predetermined threshold value.

15. (Original) The inspection apparatus using nuclear magnetic resonance
according to claim 13, wherein said arithmetic processor performs arithmetic
processing of determining frequency of appearance of said similarity coefficient and
decides, as said predetermined threshold value, said similarity coefficient in which the
sum of said frequency of appearance in a part in which said similarity frequency is
close to 1 is $1/m$ of the sum of said frequency of appearance where m is a positive
number of 3 or above.

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16. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 13, wherein said controller executes once said first pulse sequence of said (1).

17. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 13, wherein said controller performs control of repeating said first pulse sequence of said (1) at said predetermined repetition time intervals, and said arithmetic processor obtains an average of projections of said imaging section acquired from said nuclear magnetic resonance signals detected by repeating said first pulse sequence of said (1), as said reference projection.

18. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body and an arithmetic processor using said detected nuclear magnetic resonance signal to perform image reconstruction of an imaging section, wherein said controller performs (1) in the state that said living body stops exhalation, control of executing a first pulse sequence having a first time section applying, to said living body, a slice select magnetic field gradient having a positive polarity and a radiofrequency magnetic field, a second time section applying, to said living body, a readout magnetic field gradient having a negative polarity, a third time section detecting said nuclear magnetic resonance signal in the state of applying said readout magnetic field gradient having a positive polarity, and a fourth time section applying, to said living body, said readout magnetic field gradient having a negative polarity; (2)

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in the state that said living body breathes, control of repeating said first pulse sequence at predetermined repetition time intervals; (3) in the state that said living body breathes, control of executing once said first pulse sequence; (4) in the state that said living body breathes, control of executing, after said first pulse sequence of said (3), a second pulse sequence repeating, at said predetermined repetition time intervals, a pulse sequence having a fifth time section applying, to said living body, said slice select magnetic field gradient having a positive polarity and said radiofrequency magnetic field, a sixth time section applying, to said living body, respective magnetic field gradients of a phase-encoding magnetic field gradient and a readout magnetic field gradient having a negative polarity, a seventh time section detecting said nuclear magnetic resonance signal in the state of applying said readout magnetic field gradient having a positive polarity, and an eighth time section applying, to said living body, said phase-encoding magnetic field gradient having the opposite polarity of the polarity of said phase-encoding magnetic field gradient applied in said second time section and said readout magnetic field gradient having a negative polarity, by changing the magnitude of said phase-encoding magnetic field gradient; and (5) control of repeating said (3) to said (4), said arithmetic processor performs (a) arithmetic processing of one-dimensional inverse Fourier transforming said nuclear magnetic resonance signal detected in said first pulse sequence of said (1) to acquire a reference projection of said imaging section in the direction applying said readout magnetic field gradient of said imaging section; (b) arithmetic processing of one-dimensional inverse Fourier transforming said nuclear magnetic resonance signal detected in said first pulse sequence of said (2) to acquire a projection in the direction applying said readout magnetic field gradient of said imaging section; (c) arithmetic processing of determining a similarity coefficient between said projection acquired in

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said (b) and said reference projection; (d) arithmetic processing of determining a predetermined threshold value from frequency of appearance of said similarity coefficient; (e) arithmetic processing of one-dimensional inverse Fourier transforming said nuclear magnetic resonance signal detected in said first pulse sequence of said (3) to acquire a projection in the direction applying said readout magnetic field gradient of said imaging section; and (f) arithmetic processing of determining a similarity coefficient between said projection acquired in said (e) and said reference projection, said similarity coefficient being scalar, and said controller performs (6) control of collecting said nuclear magnetic resonance signals used for said image reconstruction in said second pulse sequence based on comparison of a value of said similarity coefficient determined in said (f) with said predetermined threshold value.

19. (Original) The inspection apparatus using nuclear magnetic resonance according to claim 18, wherein said controller performs control of collecting said nuclear magnetic resonance signals used for said image reconstruction in said second pulse sequence when a value of said similarity coefficient is larger than a predetermined threshold value.

20. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising a controller controlling a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body, wherein said controller performs (1) control of a first pulse sequence detecting said nuclear magnetic resonance signal to acquire a reference projection of an imaging section as the reference of monitoring of a heartbeat of said living body;

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(2) control of executing once said first pulse sequence detecting said nuclear magnetic resonance signal to acquire a projection of said imaging section used for said monitoring and of repeating a second pulse sequence detecting said nuclear magnetic resonance signal to acquire an image of said Imaging section at predetermined repetition time intervals; and (3) control of collecting said nuclear magnetic resonance signals used for image reconstruction of said imaging section in said second pulse sequence based on a similarity coefficient between said projection and said reference projection, said similarity coefficient being scalar.

21. (Currently Amended) An inspection apparatus using nuclear magnetic resonance comprising control means for executing a pulse sequence applying a radiofrequency magnetic field and a magnetic field gradient to a living body placed in a static magnetic field to detect a nuclear magnetic resonance signal produced from said living body; and means for performing reconstruction of a projection using said detected nuclear magnetic resonance signal to monitor motion of said living body, wherein said control means executes said pulse sequence acquiring said projection and determines a similarity coefficient between said projection and a reference projection acquired in engagement with said pulse sequence to monitor motion of said living body, said similarity coefficient being scalar.